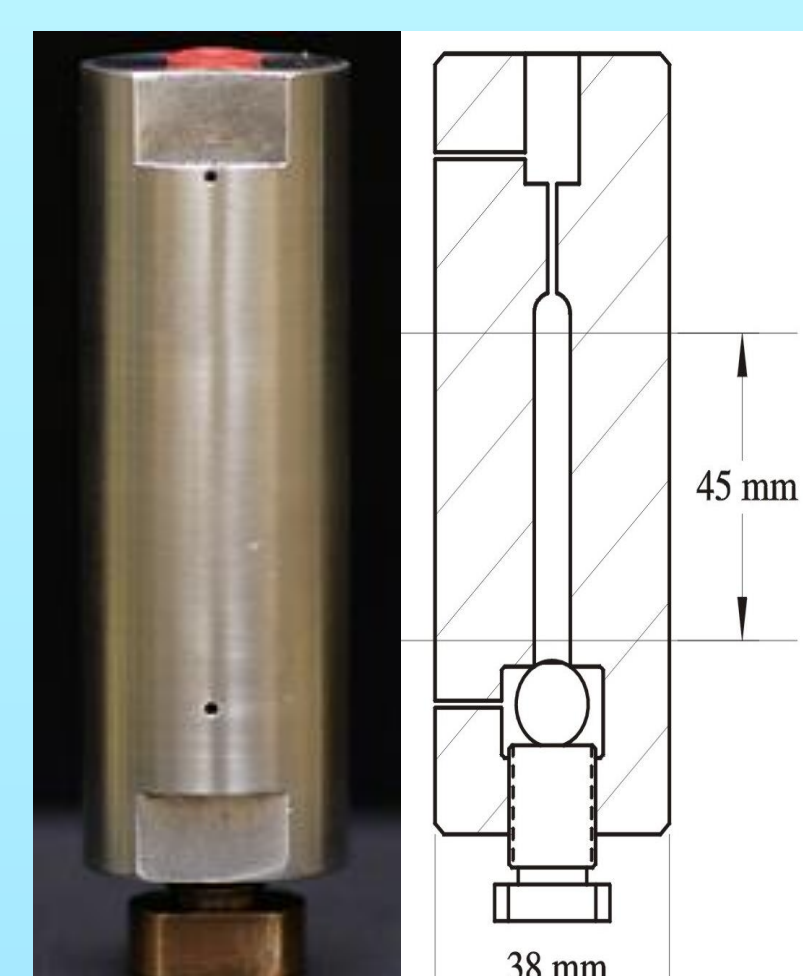


High Pressure Equipment at NCNR

Juscelino B. Leão¹, Sarah Poulton^{1,2}

¹ NIST Center for Neutron Research. Gaithersburg, MD ² University of Maryland. College Park, MD

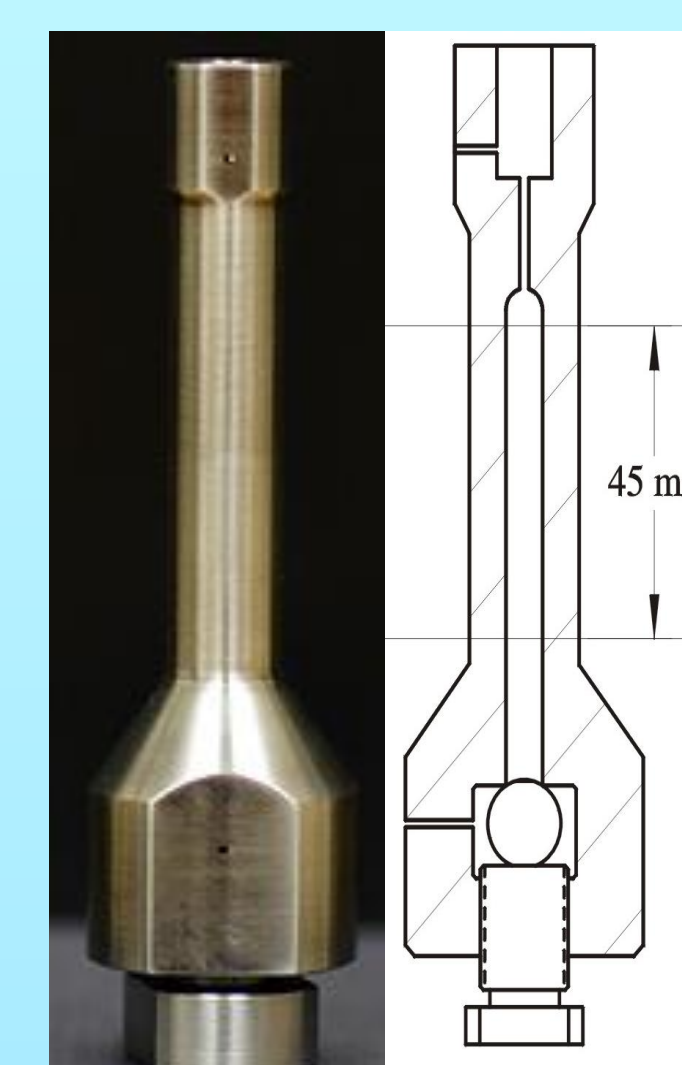
The NIST Center for Neutron Research currently provides a variety of pressure apparatus ranging from 2 MPa to as high as 2.5 Gpa that are specially designed for neutron spectroscopy. Most of the pressure equipment can be mounted in a variety of instruments throughout NCNR's facility, allowing for experimental flexibility and maximizing beam time use.



650 MPa Inert Gas Pressure Vessel

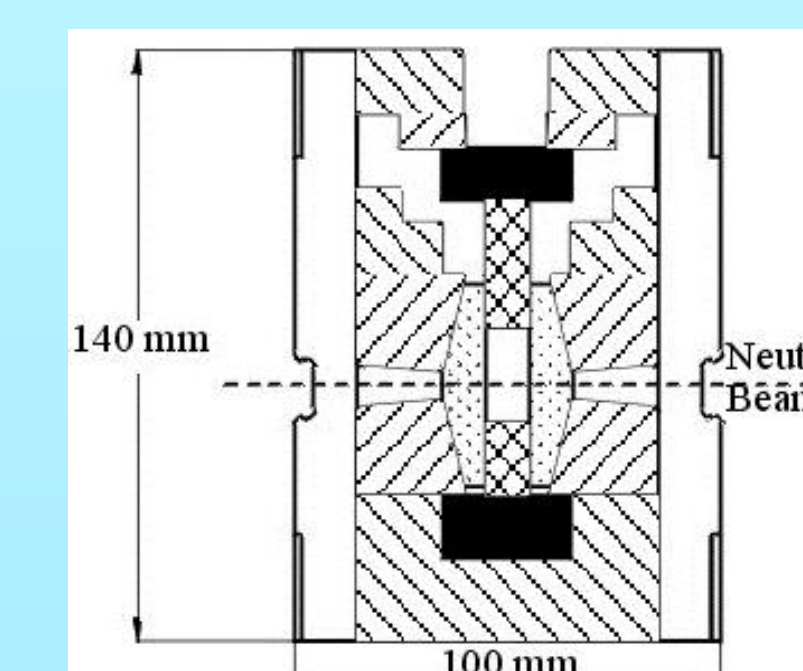
$P_{\max} = 650 \text{ MPa}$
 $1.5\text{K} < T < 300\text{K}$
 Al 7075-T6 Construction
 1.5 cm³ Sample Volume
 .635 cm dia. x 5.08 cm sample illumination
 60% Average Neutron Transmission at 2Å
 Inert Gases

$P_{\max} = 1.0 \text{ GPa}$
 $1.5\text{K} < T < 300\text{K}$
 13-8Mo Stainless Steel Construction
 2.2 cm³ Total Sample Volume
 1.5 cm³ Illuminated Sample Volume
 .635 cm dia. x 5.08 cm sample illumination
 25% average neutron transmission at 2Å
 Inert Gases



1.0 GPa Inert Gas Pressure Vessel

$P_{\max} = 2.5 \text{ GPa}$
 $1.5\text{K} \leq T \leq 300\text{K}$
 Sample Size:
 10 mm x 6 mm Ø



The sample is axially pressurized between two opposing cylindrical Tungsten Carbide pistons. Hydrostatic uniformity is ensured by immersing the sample in a pressure transmitting media such as Fluorinert FC75, (C₈F₁₈), or a 4:1 mixture of deuterated methanol and ethanol. Pressure is monitored through the change in lattice parameters of NaCl.

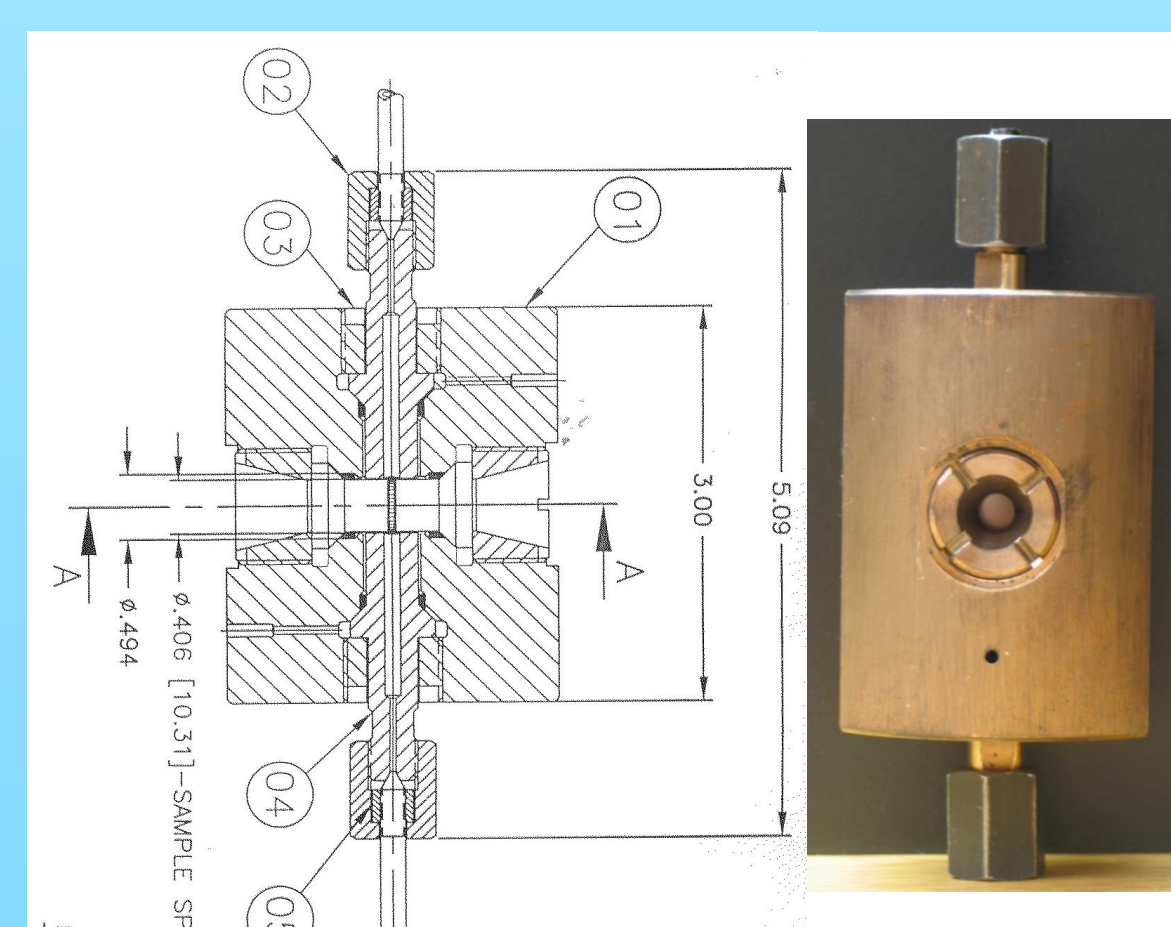


McWhan Clamp Cell schematics and as seen mounted on SD-55 (below)



Air Sensitive/Gas Loading
 $P_{\max} = 1.4 \text{ MPa}$ (Vanadium)
 up to 50 MPa (Aluminum)
 $1.5\text{K} \leq T \leq 800\text{K}$

Air sensitive closure with vanadium sample can

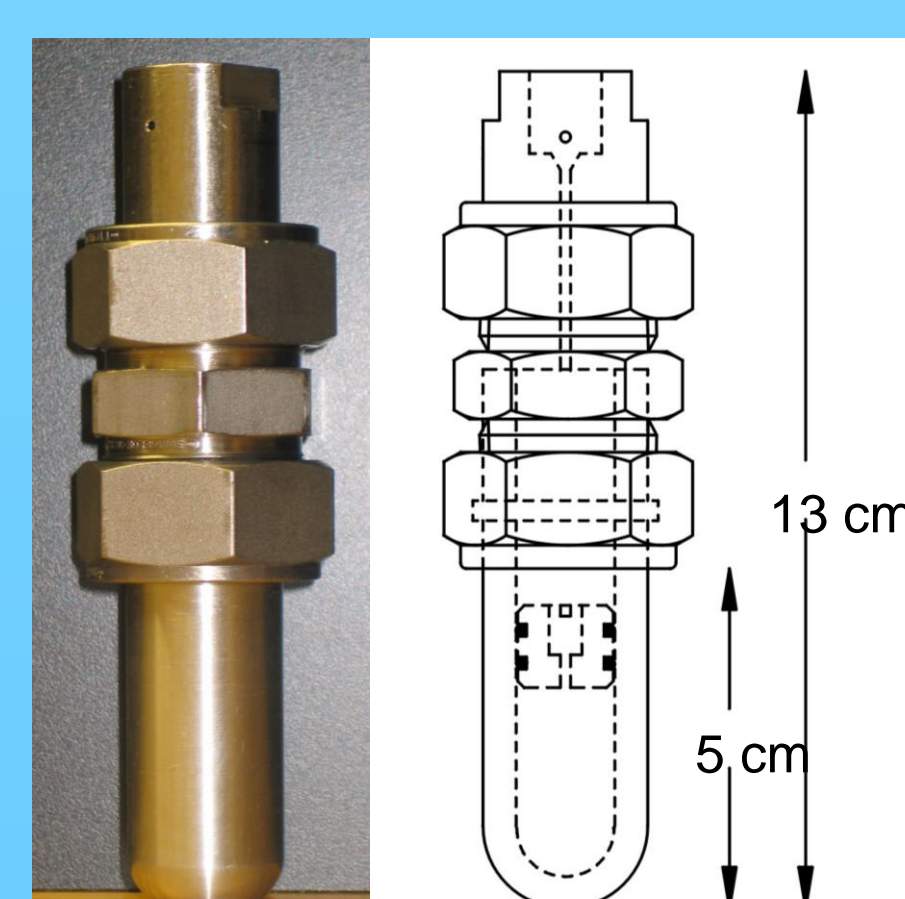


300 MPa Sapphire Window Pressure Vessel

$P_{\max}^* = 300 \text{ MPa}$
 $\text{LN}_2^* < T < 350\text{K}$
 CuBe Construction with Sapphire Windows
 2.2 cm³ Total Sample Volume
 Neutron Beam Cross-section Area 0.3 cm²
 Beam Divergence Angle $\Theta \approx 15^\circ$
 Inert Gases

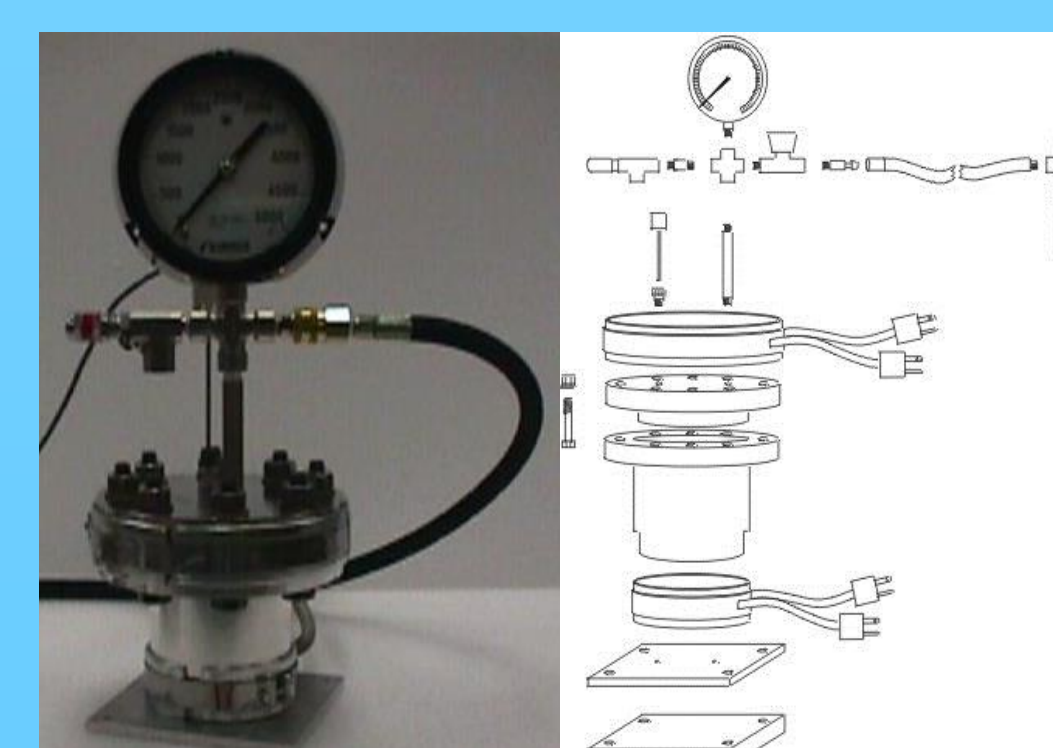
* Under Testing

$P_{\max} = 100 \text{ MPa}$
 $260\text{K} < T < 380\text{K}$
 Al 7075-T6 Body
 Variable Annulus Insert
 9.0 cm³ Sample Cross Section Area
 75% average neutron transmission at 2Å
 Inert Liquids Pressure Media
 Used in tandem with TLCCR



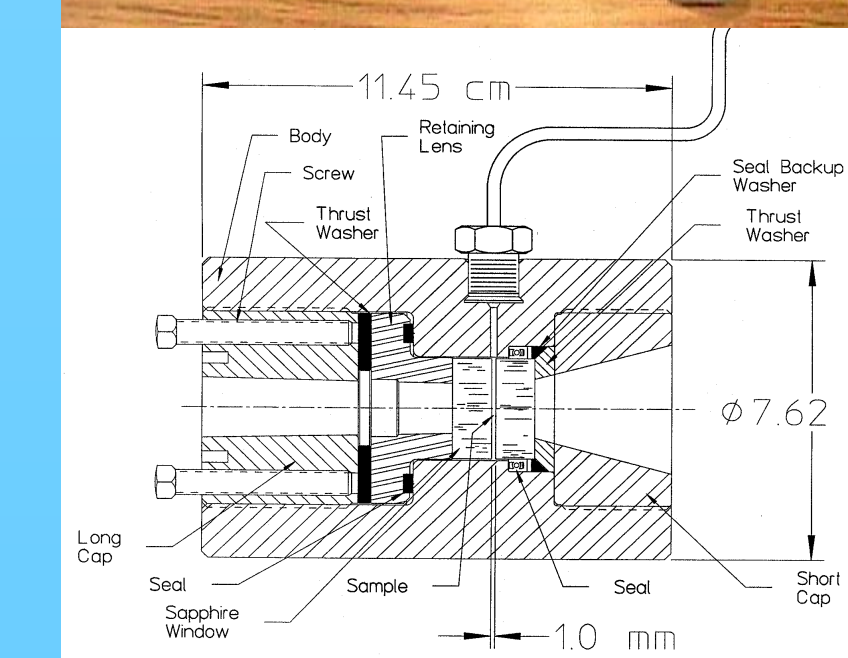
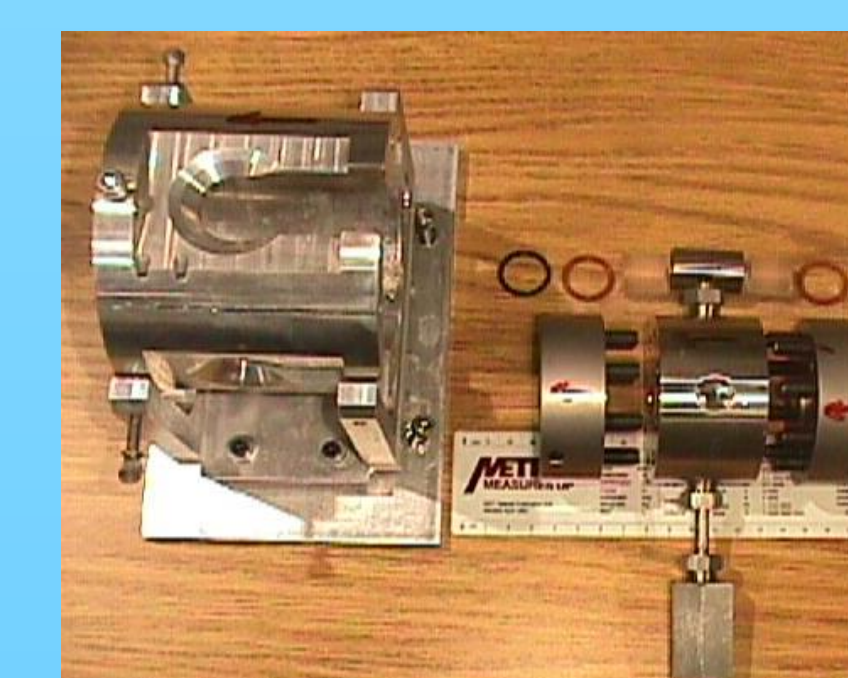
100 MPa Piston Pressure Vessel

$P_{\max} = 20 \text{ MPa}$
 $300\text{K} < T < 380\text{K}$
 Al 6061-T6 Body
 Variable Annulus Insert
 up to 7cm diameter wafers
 Inert gases Pressure Media



Small Angle Thin Films Pressure Vessel.

$P_{\max} = 300 \text{ MPa}$
 $258\text{K} \leq T \leq 440\text{K}$
 Stainless steel body
 with two containment
 sapphire windows



SANS Hydraulic Pressure Vessel

This vessel can be used to pressurize polymer melt mixtures in a wafer form (blends and copolymers confined by an encapsulated o-ring) or soft macromolecular fluids (solutions, micellar systems). Also used to pressurize flowing liquids though the use of a separator (high pressure tubing containing a piston between the pressurizing fluid and the sample).